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Banksia croajingolensis (Proteaceae) a new species from East Gippsland, Victoria

W M Molyneux[1] and S G Forrester[2]

[1]*La Trobe University, Department of Botany, Life Sciences School, Bundoora 3076 Victoria, Australia*
[2]*200 Beachs Lane, Dixons Creek 3775 Victoria, Australia*

Abstract

Banksia croajingolensis Molyneux & Forrester is described and illustrated. Its relationships with *Banksia integrifolia, Banksia marginata* and *Banksia paludosa* are discussed.

Introduction

A new previously unrecorded species of *Banksia* was discovered by the authors in 2000 and identified at the time as *Banksia paludosa*. The new species is distinguished from *Banksia integrifolia, Banksia marginata* and *B. paludosa*, with which it shares certain character states. It is a narrow endemic apparently confined to one drainage line on a coastal heathland in Croajingolong National Park. It is sympatric on its margins with *B. integrifolia* and *B. marginata* but not with *B. paludosa*, which is not recorded for Victoria (Jeanes 1996). This latter species occurs in New South Wales (Harden 2002) with its southern limits on coastal heathlands and nearby forest sites about 35 km to the north-east of the new species. It is further separated from the new species by its position on the north side of the Howe Range and by the extensive Mallacoota Inlet lake system. This system has probably presented a barrier to the migration of plants such as *Banksia* since the last Ice Age. The authors did discover a small population of a dwarfed *Banksia* in June 2006 on an adjoining heathland to the north of the *B. croajingolensis* population which would appear to have some affinities to *B. paludosa*. Its regularly toothed leaf margin is a character shared with *B. paludosa* populations in southern NSW but not with adult foliage of *B. croajingolensis, B. integrifolia* or *B. marginata*. It may suggest either an earlier presence of *B. paludosa* in Victoria or a closer proximity which may have facilitated cross pollination.

Taxonomy

Banksia croajingolensis Molyneux & Forrester ***sp. nov.***

A *B. paludosa* R. Br. foliis integris plerumque obtusis interdum lobatis apicem versus, internodiis brevioribus, a *B. integrifolia* L. f. habitu minore floribus in fructu persistentibus et seminibus ultra unum annum retentis, a *B. marginata* Cav. foliis nec

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semper emarginatis nec truncatis et floribus et infructescentiis minoribus differt. Ab omnibus speciebus indicatis processu florentis basipeto non acropeto differt.

Type: Victoria, Croajingolong National Park, south-western heathland above Shipwreck Creek, c 12 km south-west of Mallacoota, *Molyneux & Forrester s.n.*, 21 June.2006 (holo: MEL 2292847; iso: CANB, NSW)

A mostly small, rarely larger, spreading lignotuberous *shrub* propagating by sexual means and extending asexually by the production of ramets, 35–60(–100) cm tall and 45–120 cm wide. *Branchlets* initially trigonous soon becoming rounded, either glabrous with yellow and red markings or lightly white or rusty pubescent and soon becoming glabrous, nodes crowded. *Leaves* verticillate, sub-verticillate or scattered (more commonly sub-verticillate), narrowly obovate, obtuse, entire or seldom irregularly notched towards apex, shortly apiculate or emarginate, 16–60 mm long, 5–17 mm wide, glabrous above or with early scattered hairs, shiny, primary nerves evident, mid-vein recessed, undersurface appearing white-tomentose, with evident nerves and reticulum; nerves occasionally lightly woolly, mid vein glabrous or less often with a light ferruginous indumentum, margins recurved. *Juvenile ramets* glabrous, stems angular, leaves obovate-cuneate, truncate, emarginate or obtuse, irregularly toothed, sub-verticillate or scattered, 12–55 mm long, 6–8 mm wide. *Conflorescences* cylindrical, terminal or from older wood within canopy, 70–140 mm long, 42–55 mm wide at flowering, basipetalous, shortly pedunculate, basal bracts linear-subulate, ferruginous-tomentose in c. three rows mostly 3(–5) mm long, common bracts ± rhomboidal, white-tomentose or lightly silky-ferruginous, 1.8–2.1 mm across. *Flowers* openly spaced mostly at 90° to rachis, yellow with grey-brown, grey-green or golden pubescence, perianth 15–18 mm long including limb of 3.5 mm perianth c. 0.5 mm wide, tepals twisting, spreading to base, limb acute, pistil slender, glabrous 15–26 mm long including style end, straight or bowed sharply just before anthesis, ovary c. 0.8 mm long with few villous hairs at base, style end not thickened c. 1.5 mm long, about same width as style; spent styles variously at 90° to rachis, straight or relaxed at 70–80° to rachis; old flowers retained for several years. *Infructescences* 90–120 mm long, 35–38 mm wide, follicles elliptical 13–19 mm long, 3–5 mm high, (4–)5–6(–8) mm wide, *Seed* obovate-cuneate, 8–10 mm long, 3–3.5 mm wide, wing 11–12 mm high, 12–13 mm wide. (Fig. 1).

Recommended vernacular: **Gippsland Banksia**

Distribution: apparently endemic to East Gippsland, Victoria, where confined to a single short drainage line draining north from a coastal heathland elevated above the south bank of Shipwreck Creek, c. 12 km SW of Mallacoota. The population of about 480 individuals is confined within the following coordinates: 37°38'98"S, 149°41'63"E (on its southern boundary); 37°38'95"S, 149°41'70"E (on its northern boundary); 37°38'99"S, 149°41'64"E (on its western boundary); 37°38'95"S, 149°41'65"E (on its eastern boundary).

Habitat: *Banksia croajingolensis* is emergent from mixed coastal heathland vegetation in moist sandy soils associated with *Acacia suaveolens, Allocasuarina paludosa, Babingtonia pluriflora, Epacris impressa, Hakea teretifolia, Patersonia occidentalis, Persoonia laevis, Xanthorrhoea resinosa* and various sedges and rushes. Both *B. integrifolia* and *B. marginata* are sympatric on the margins of the *B. croajingolensis* stand. *Banksia marginata* tends to be a sub-shrub within or just emerging from the dense heathland canopy on the eastern margins of the stand whereas *B. croajingolensis* is always emergent. It is strongly

Fig. 1. *Banksia croajingolensis* illustrating variation in bud colour, basipetalous flowering sequence, the mostly sub-verticellate leaf arrangement, evident nerves and reticulum on lower leaf surface, and mature infructescences with retained seed.

sympatric with *B. integrifolia* on its western margins and on the edges of woodland containing *Banksia serrata, Eucalyptus sieberi* and an undescribed eucalypt with affinity to *E. globoidea*. On its northern boundary it is sympatric with apparent hybrid swarms including *B. integrifolia* and an unknown second parent.

The underlying geology is strongly banded and distorted mudstone and slates of Ordovician origin.

Etymology: the specific epithet commemorates the Gunai/Kurnai Nation name for the region from which the species is currently known. The original name Krowathunkoolong was adapted in the early days of European settlement to Croajingolong, the name of the county to which the new species is apparently endemic. The epithet 'croajingolensis' is a euphonic contraction of the less appealing 'croajingolongensis' as suggested by Johnson and Hill (1990) when they described *Eucalyptus croajingolensis*.

Conservation Status: using the IUCN Red List Categories and criteria (IUCN 2001), the new species is assessed as Vulnerable with a conservation code of VU D1+2 on account of its small population size, very restricted area of occupancy and restriction to a single location.

Representative specimens examined: Victoria: Croajingolong National Park, above Shipwreck Creek, [ca. 12 km SW of Mallacoota], *Molyneux & Forrester*, 24 Aug 2005 (MEL 2292848, MEL 2292849, MEL 2292856); ibid., 17 vi 2006, (MEL 2292860, MEL 2288265).

Discussion

The new species differs from *B. paludosa* in having entire mostly obtuse leaves with occasional lobing toward the apex, and much shorter leaf internodes; from *B. integrifolia* which is a large shrub or small tree which sheds its flowers following anthesis and with seed dehiscing usually within one year; and from *B. marginata* which has consistently truncate and often emarginate leaves, and much smaller flowers and generally much smaller conflorescences and infructescences.

It differs from all of the above three species in being basipetalous, not acropetalous, in its flowering sequence. This difference in flowering sequence raises questions as to the classification of *B. croajingolensis* within Banksia. In all states other than flowering sequence, it nests within section *Banksia* of subgenus *Banksia* (species with straight style ends). This sequence is common in the eastern species *B. ericifolia* and the *B. spinulosa* group and a number of Western Australian species in series *Spicigerae* of section *Oncostylis* and with *Banksia quercifolia* and *Banksia oreophila* which form series *Quercinae* of section *Banksia*. When considering the basipetaous sequence of flowering in *B. croajingolensis* compared with other species in section *Banksia*, it may be necessary to consider also whether a basipetal sequence implies a broader relationship to other taxa sharing this feature. As this flowering sequence is shared across different series and sections of subgenus *Banksia* across southern Australia, it is possible that they arose spontaneously and independently of other groups' genetic input.

The flowering sequence anomaly in *B. croajingolensis* compared with other members of series *Banksiae* of section *Banksia*, with which it otherwise shares many character states, may require it to be recognized in a new series.

The table of comparison with *B. croajingolensis* (Table 1) includes close regional forms of *B. integrifolia* and *B. marginata* and southern New South Wales forms of *B. paludosa* from similar coastal or near coastal localities. These are all members of *Banksia* series *Banksiae*. Whilst *B. integrifolia* and *B. marginata* are sympatric with the new species, the *B. paludosa* collections used for comparison are from heathland and woodland populations in Nadgee Nature Reserve and Green Cape in south-eastern New South Wales. *Banksia serrata* was not included as a comparator as it is a member of *Banksia* series *Orthostylis* [and apparently not implicated in the ancestry of *B. croajingolensis*]. It would appear from both physical observations and morphometric measurements that *B. integrifolia, B. marginata* and *B. paludosa* have influenced the development of *B. croajingolensis* and that this species may have resulted from various crossings and back crossings between them. In seedling trials conducted from 2006 to 2007, there was no apparent segregation in the offspring of *B. croajingolensis*. It is genetically segregated from the other three species because it is self perpetuating and clonal, and forms a substantial population. This cannot be said of the other three species as it can be demonstrated that there is clear hybridization between all of them, which has resulted in long standing confusion regarding the identity of certain specimens.

Over approximately eight years of field study on the banksias of south-eastern NSW and far eastern Victoria from Green Cape in NSW to Shipwreck Creek and Sandpatch heathlands in Victoria, the authors have noted a number of these apparent hybrid swarms.

In 1972 one of us (WMM) collected seed of a 'robust' *B. paludosa* among typical specimens on the middle south-west slopes of Green Cape. The few progeny which resulted from their germination appeared to share characters of *B. paludosa* and *B. integrifolia*, which are closely related.

In 2004 the authors discovered a small population of a large spreading banksia up to ± 2 m tall on the lower south-west slopes of Green Cape. This small stand grew sympatrically with both dwarfed *B. paludosa* and small tree forms of *B. integrifolia*.

Investigations of major characters such as branchlet indumentum, leaf undersurface indumentum, flower colour, the degree of spent flower retention and of long or short term seed retention, indicated that these stands should be regarded as hybrids between the two species.

During field work at Impressa Moor in Nadgee Nature Reserve with Head Ranger Lyn Bell, we found distinct variations in specimens which we had at first thought were either *B paludosa* or *B. marginata*. We recorded character states in these plants which appeared to be intermediate between these two species. Some of these are not unlike the small population with affinities to *B. paludosa* which the authors collected in June 2006 on the northern heathland above Shipwreck Creek (about 50 plants ± 35 cm tall x 40 cm wide). The Impressa Moor population was growing sympatrically with the local small heathland form of *B. marginata*.

In the region south west of Mallacoota putative hybrid swarms between *B. integrifolia* and *B. marginata* are not uncommon. Large but rounded *B. integrifolia*-like plants co-exist with more typical upright narrow forms, but while the latter shed old flowers and seed at an early stage, some specimens of the former retain both flower and seed over a long period. The influence here would seem to be *B. marginata* as it is to the south of the nearby Mallacoota Aerodrome on the margin of *Melaleuca armillaris* stands.

Table 1. Comparison between *B. croajingolensis, B. marginata, B. paludosa* and *B. integrifolia*.

Character	*B croajingolensis*	*B marginata*	*B paludosa*	*B integrifolia*
Habit				
Size	Mostly small	Small	Small to medium	Medium to tall
Shape	Spreading	Spreading	Spreading	Upright
Branchlets				
Indumentum	Glabrous or initially pubescent, soon glabrescent	Villous, often into third year	Glabrous	Villous, often into second year
Colour	Red or yellow	Green	Red or yellow	Green, often becoming yellow or red
Leaves				
Shape	Narrowly obovate	Linear to oblong	Lanceolate to obovate	Broadly or narrowly obovate
Margin	Seldom irregularly notched towards apex	Entire	Dentate	Entire in adult phase
Apex	Obtuse, shortly apiculate or emarginate	Truncate, often emarginate	Obtuse	Obtuse
Phyllotaxis	Verticillate, sub-verticillate or scattered	Alternate, scattered	Verticillate	Verticillate
Node to Node length	Short	Short	Widely spaced	Mostly widely spaced
Adaxial surface	Glabrous, shiny	Hirsute dull, becoming glabrous	Glabrous, glossy	Glabrous, shiny when young
Abaxial surface	White woolly but with main nerves and reticulum evident	White woolly, nerves not visible reticulum evident	Appearing green with prominent, main nerves and reticulum, with white woolly indumentum in reticulum pits, occasionally encroaching on the reticulum	Woolly white, main nerves and reticulum not visible
Margins	Recurved	Recurved to revolute	Recurved	Recurved
Length	16–60 mm	12–42 mm	40–130 mm	26–100 mm
Width	5–17 mm	3–9 mm	15–35 mm	7–20 mm
Conflorescence				
Shape	Cylindrical	Cylindrical to marginally ovoid	Cylindrical	Cylindrical
Position	Terminal on branchlets and older wood, often subtended by branchlets	Terminal on branchlets or older wood and often subtended by branchlets	Terminal or more often on older wood	Terminal on or older wood and often subtended by branchlets

Character	*B croajingolensis*	*B marginata*	*B paludosa*	*B integrifolia*
Height	70–140 mm	40–70 mm	70–130 mm	110–150 mm
Width at flowering	42–55 mm	45–47 mm	45–50 mm	60–70 mm
Flowers				
Arrangement on rachis	Open	Close	Open	Close
Colour in bud	Yellow with a grey brown, grey green or golden pubescence	Lemon with grey pubescence	Yellow with golden brown pubescence	Yellow with a white pubescence
Sequence	Basipetalous	Acropetalous	Acropetalous	Acropetalous
Style				
Posture prior to anthesis	Straight or bowed	Bowed	Straight or slightly bowed	Bowed
Colour	Yellow	Pale yellow	Yellow	Pale yellow
Length	15–26 mm	20–31 mm	17–20 mm	27–32 mm
Infructescence				
Height	90–120 mm	45–50 mm	75–110 mm	75–85 mm
Width	35–38 mm	28–30 mm	40–45 mm	28–32 mm
Seed				
Shape	Obovate cuneate	Falcate cuneate	Obovate falcate	Narrowly obovate cuneate
Length	8–10 mm	5–7 mm	7.5–8 mm	8–9 mm
Width	3–3.5 mm	3 mm	3.5 mm	3.5–4 mm
Wing Length	11–12 mm	7–9 mm	9–10 mm	10–11 mm
Wing Width	12–13 mm	8–9 mm	10–12 mm	6–8 mm

All colour coding 1986 Edition RHS Swatch.

Unfortunately, in many instances specimens of these swarms have been assigned indiscriminately to either *B. integrifolia* or *B. marginata*. This suggests that further detailed study of all *Banksia* populations within this region is needed. The anomalous habitat of *B. integrifolia* on the lower middle reaches of the Betka River, where it grows as a rheophytic chasmophyte, warrants investigation. *Banksia integrifolia* is also recorded from the lower reaches of the Genoa River gorge many kilometres upstream from the coast.

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References

Harden GJ (2002) *Banksia*. Pp. 82–86 in Harden GJ (ed.) *Flora of New South Wales*, revised edition, vol. 2. (New South Wales University Press: Kensington)

IUCN (2001) IUCN Red List Categories: Version 3.1. Prepared by the IUCN Species Survival Commission. (IUCN: Gland & Cambridge)

Jeanes JA (1996) *Banksia*. Pp. 882–887 in Walsh NG & Entwisle TJ (eds) *Flora of Victoria*, vol. 3. (Inkata Press: Melbourne)

Johnson LAS & Hill KD (1990) New taxa and combinations in *Eucalyptus* and *Angophora*. *Telopea* 4: 37–108.

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